

Technologies: People and Priorities

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Abstract

This paper is concerned with the decisions and processes that generate mechanical, biological, and chemical technologies that have an impact on life in the semi-arid tropics (SAT). The author makes these assumptions: that such technologies, separately or combined, influence social relations and the distribution of benefits within societies; that in much of the SAT, rural populations are increasing and will continue to do so for decades to come; and that there is room for maneuver in setting research and development priorities and in decisions taken during the research and development (R & D) process. The central issue is how to optimize decisions and action that affect and are part of R & D. It is contended that modes of thought, values, and criteria need to be re-examined. In much of the literature of agricultural development, including agricultural economics, people are treated as resources rather than users of resources — a means rather than ends. And thinking about research priorities often starts with a crop or a farm system or a mechanical technology rather than with the poorer people in a rural environment and their interests and future. The author suggests that decision-making and research might be improved through expanding environment-specific research, conducting more of it in collaboration with rural people, developing cost-effective methods for rural appraisal, changing professional reward systems, enabling professionals to become individually more multidisciplinary, and learning from the true multidisciplinary, the rural people themselves.

"If everybody minded their own business," said the Duchess in a hoarse growl, "the world would go round a deal faster than it does." Lewis Carroll, *Alice in Wonderland*.

"When the rockets go up, who cares where they come down? That's not my department..." Tom Lehrer song.

In this paper "socioeconomics" is taken to include the concerns of the social sciences generally, and not just sociology and economics. It would be artificial, restrictive, and

unhelpful to make the scope narrower. "Prospective technologies" are similarly interpreted widely to include technologies that are "in prospect" in the sense of being actively developed, and also others that are not being developed but might be developed if accorded priority. "Technologies" include mechanical, biological, and chemical technologies. The Ft & D discussed is the formal R & D of organizations and not the informal R & D of rural people, important though the latter is.

Analysis of the socioeconomics of prospective technologies can focus on the receiving environments or on the processes that generate the technologies, or on both. Though considering both, this paper is primarily concerned with the decisions and processes that generate technologies, since this is where many important choices lie. It is not concerned with the diffusion of technologies that already exist. The central issue is how to optimize decisions and action that affect and are part of R & D processes.

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EDITORS' NOTE: In preparing for the workshop, Dr. Chambers wrote this thoughtful paper on the subject of the session. Although he also was asked to open discussion it was felt this paper merited Inclusion as a separate contribution to follow his comments on the papers formally presented.

In approaching this issue, three assumptions are made.

First, in the semi-arid tropics (SAT), mechanical, biological, and chemical technologies, separately or combined, influence social relations and the distribution of benefits within societies. Prospective technologies can be expected to continue to exert such influences. Decisions about research priorities and decisions within the R & D process are therefore political and value-laden in their implications, however technical they may appear. In receiving environments, the "talents effect" as Andrew Pearce(1977) has called it after the biblical parable, is widely prevalent, so that those who have more get more and those who have less may lose even the little that they have. But

technologies vary widely in the ease or difficulty with which they can be captured and used by different categories of people, and they can be designed with target groups in mind, including poorer people. Whether deliberately or by default, a social policy is built into new technology.

Second, in much of the SAT, proportions as between population, land and water are changing and will continue to change. In almost all areas, rural populations are increasing and can be expected to continue to increase. Short of some demographic disaster, and in spite of high levels projected for rural-urban migration, rural populations in most countries will continue to grow rapidly for decades. Table 1 indicates orders of magnitude: rural populations in most

Table 1. Rural and urban population projections for some countries wholly or partly in the semi-arid tropics.^a

	1975 (millions)		2000 (millions)		% increases 1975-2000	
	rural	urban	rural	urban	rural	urban
Angola	5.2	1.2	8.1	4.4	55	278
Bolivia	3.4	2.0	4.8	5.4	43	169
Botswana	0.6	0.1	1.0	0.4	65	459
Chad	3.5	0.6	4.9	2.0	42	254
Ethiopia	24.8	3.1	42.2	11.4	70	265
India	481.5	131.8	717.3	342.0	49	160
Kenya	11.8	1.5	24.6	6.4	109	328
Mali	4.9	0.8	8.7	2.6	76	237
Mexico	21.8	37.4	28.7	103.6	32	177
Mozambique	8.7	0.6	15.3	2.3	77	300
Niger	4.2	0.4	7.9	1.6	90	283
Nigeria	51.5	11.4	94.0	40.9	82	259
Pakistan	51.6	19.0	84.6	62.3	64	228
Paraguay	1.7	1.0	2.6	2.6	59	167
Rhodesia	5.0	1.2	10.1	5.0	100	309
Senegal	3.2	1.3	4.7	3.5	48	179
Sudan	15.9	2.4	30.0	8.9	89	271
Tanzania	14.4	1.0	29.8	4.25	107	307
Thailand	35.1	7.0	62.2	23.4	77	236
Upper Volta	5.5	0.5	9.2	1.7	67	244
Zambia	3.2	1.8	4.6	7.0	44	280

a. Source: FAO, based on data a few years old. More recent figures would probably generally show slightly lower percentage increases, but without affecting orders of magnitude. Percentages are based on the original figures which were in thousands, and which have here been rounded to millions to one decimal place. Brazil has not been included because much less than half its area is in the SAT. Its percentage increases for the country as a whole are, however, estimated at only 13% rural (44.5 million to 90.3) and 149% urban (65.3 million to 162.2).

of the SAT countries are projected by the FAO to increase in average of about 58% between 1975 and 2000. Percentage rates of increase of rural populations in the SAT are estimated to be generally lowest in Central and South America (Mexico 32%, Bolivia 43%), with Asia higher (India 49%, Pakistan 64%, Thailand 77%), and West and East Africa highest (Nigeria 82%, Ethiopia 70%, Tanzania 107%, Kenya 109%). Since these are national averages, some local and regional increases will be higher. Locally, too, resources will be augmented (as through irrigation, forestry, imported inputs such as chemical fertilizer) or diminished (as through depletion of groundwater, removal of forests, declining soil fertility, and soil erosion). There may be a widespread phenomenon of poorer people, as in parts of Kenya (Mbithi and Barnes 1975; Johnston 1979), migrating into lower rainfall and fragile environments, which they then degrade irreversibly with the possibility of a later backwash of refugees returning to densely populated higher potential areas.

The third assumption is that there is room for maneuver in setting R & D priorities and in decisions taken during the R & D process, and that more room could be made. This is a controversial point. On the one hand, we have the experience of market and institutional forces combining to give priority and resources to research that benefits the better-off and that has often concentrated on commodities for export. We have examples of pressures from commercial producers for research that favors their interests but may not favor the smaller farmers (e.g. Sanders 1979). We have the theory of induced innovation that sees innovation as a response, albeit sometimes lagged, to factor proportions and prices (Ruttan 1977). But on the other hand, research institutions in the public sector are to varying degrees insulated from political pressures. The international research institutes, more than most, have discretion or mandate to give priority to the interests of those rural people who are without voice and who are unable to make demands upon research. They are also well-placed, through their prestige and their training programs, to strengthen new professional values and to influence the incentives and rewards in national research systems that induce priorities and affect behavior among other scientists. Further, in the "post-green revolution" period, there is now

heightened awareness of the social and economic implications of research decisions. This should extend the room for maneuver in using R & D as a means for conscious social engineering.

These three assumptions bear on the question of how to optimize decisions and action in R & D. Questions can be asked about three clusters of points:

- modes of thought, values and criteria
- future orientation
- professionalism and priorities.

Modes of Thought, Values, and Criteria

Introspection is a first step. How have we been programmed to think about research? What points of departure and modes of thought are dominant? The words used in discussion reflect implicit priorities and direct attention in some directions rather than others. For example, what meanings are likely to be attributed to the word "development" when it is set in the phrase "socioeconomic constraints to development of semi-arid tropical agriculture?" Is it rural development as defined in the World Bank Sector Paper on Rural Development?

Rural development is a strategy designed to improve the economic and social life of a specific group of people—the rural poor. It involves extending the benefits of development to the *poorest* among those who seek a livelihood in the rural areas. The group includes small-scale farmers, tenants and the landless. (World Bank 1975 : my emphasis)

Or is it increasing agricultural production? Or does it mean different things to different people, or different things to the same people at different times, in different contexts?

Much of the literature, especially in agricultural economics, tends to equate development with agricultural production. People are treated as resources rather than users of resources, as constraints rather than purposes, as means rather than ends. Discussing poverty we then talk clinically about the low productivity of human resources, underutilization of labor resources in rural areas (Ruttan 1977, pp213, 215), and even the efficiency loss to society of human capital deterioration (Sanders 1979, p 16). People are quantified as labor, as faceless figures in factor proportions. All this has its

uses; without careful numerate analysis good decisions would be harder. But the dangers are also great. Those most in need-the poorest-may be treated as a residual rather than as a primary focus, and technical euphemisms such as "underutilized labor resources" and "human capital deterioration" may hide acutely deprived people.

If people are the starting point, then they should come first in lists of criteria for ex-ante appraisal of prospective technologies. There is, of course, much scope for argument here about direct and indirect benefits to the poorer people. The issues are not simple. But in terms of the World Bank definition, there is a case for ex-ante analysis that starts with all the people in a given environment, including and especially the poorest and the landless. It can be misleading to suggest that "the farmers with tiny landholdings" are "the poorest of the poor."¹ They may be; but often they are not.

Starting with people, a key priority is the creation of adequate livelihoods. Where these are not already adequate, a criterion becomes the net livelihood-intensity of prospective technology in a receiving environment. Livelihood-intensity here is the extent to which a technology would generate or sustain livelihoods at or above an acceptable level. It is not the same as labor-intensity. The livelihood-intensity of a technology is not constant; it is specific to an environment and is sensitive to seasonalities. For example, a technology that provided food or income flows for poor people

during lean periods of the year so as to push them above a minimum for the whole year would, in the environment concerned, have a high livelihood-intensity. The *net* livelihood-intensity is specified because a new technology usually displaces an old one that was already generating and sustaining livelihoods.

In practice, however, where does thinking about research priorities start? How often, and in what circumstances, does it start with the poorer people in a rural environment and their interests and their futures? Does such thinking in practice start from other points and ask other questions, starting with a crop, or a farm system, or a mechanical technology, or a problem (a pest, a water deficit, salinity, a "constraint"), and proceed through the avenues of technical analysis, or technical plus economic analysis? Does it approach actual people only through the analysis of factor proportions and prices and the underutilization and low productivity of human resources? Do such formulations run the risk of making things worse for some of the poorer people? Are opportunities missed to improve the lots of poorer people?

Future Orientation

In the theory of induced innovation, research responds to changing factor proportions. There is a process of dynamic adjustment to changing relative factor prices (Ruttan 1977). In this adjustment there may be time lags, sometimes of decades. Thus factor proportions and prices change first, and priorities follow later. Koppel, however, has argued that assessment of technology should be future-oriented (1978, pp 6-7). By this he means that it should anticipate the consequences of prospective decisions, rather than be an exercise in forecasting. This may not go far enough.

Forecasting has been discredited to the point that the word "futurology" is used with disdain. Perhaps this is in part because the arrogance of futurologists has been matched so often by the enormity of their errors. It has, however, been practiced mainly in fields of complex and rapid change and of high uncertainty, and mainly in the rich countries; in Third World countries it has concentrated on urban and industrial development, again areas of relatively high uncertainty. But are changes in population, in relative factor proportions, and in technology in rural

1. Quotation from statement prepared by Dr. Sterling Wortman, Vice-President, Rockefeller Foundation for two Subcommittees of the US House of Representatives, 23 September 1975, quoted in Sprague 1976. The full relevant part of the quotation in Sprague is: "The bulk of the basic food supplies of the agrarian nations are produced by the many farmers with tiny landholdings, often in remote and isolated areas, plus those people in coastal areas who depend upon near-shore fisheries and aquaculture for a livelihood. For the most part, the gains in productivity and income of these rural people-the poorest of the poor-will require the development for and use by many farmers of new high-yielding, science-based crop and animal production systems tailored to the unique combination of soil, climate, biological, and economic conditions of every locality in every nation."

areas in the SATs as uncertain? Might a guess at the rural population in a SAT region in the year 2000, say, inspire more confidence than a guess at the anti-anti... missile-missile technology of the same year? And might it be made with much less expensive research? If so, it may not be too difficult to be ahead of the game. Environment by environment, future endowments and proportions could be estimated and, at the very least, directions of change identified. Research priorities might then be reviewed, bearing in mind probable gestation periods for setting up institutions, recruiting staff, conducting R & D, and then enabling and allowing diffusion. Instead of waiting for factor proportions to change, the approach would be to anticipate their change, and thereby to help generate adequate future livelihoods.

Professionalism and Priorities

It is easy to add research objectives to lists of criteria. Technical scientists cannot be uniformly pleased with their social science colleagues for having made decisions more complicated. Suggesting that adequate livelihoods should be placed at the center of research objectives for many environments, and that priorities should follow from environment-specific and future-oriented analysis, may appear to be the last straws. Agricultural scientists and engineers may sometimes despair at the failure of some social scientists to understand the nature of their work. Social scientists, it may seem, have compulsions to multiply criteria; no sooner is one set met than another is added, so that the technical scientists can never win. In suggesting any new criteria, there is an obligation to see if, at the same time, decision-making and research can be made more manageable. Four complementary suggestions follow. All would bring scientists closer, in thinking and understanding, to rural people and rural environments.

First, research might generally move physically closer to and into rural environments and be carried out in closer collaboration with rural people. Some activities are best carried out under controlled conditions on research stations; others are most efficiently carried out with farmers as collaborators and evaluators (Hildebrand 1977, pp 14-15). Biological research can be viewed along a spectrum from

very basic research in supportive sciences, such as genetics, to very applied operational research on farmers' fields (Binswanger and Ryan 1977, p 221). There are institutional, professional, and personal reasons of convenience that tend to concentrate personnel and resources at the basic research and research station end of the spectrum. The high returns to agricultural research suggest that resources devoted to it should be expanded. Much recent experience suggests that that expansion should coincide with and reinforce more decentralization of research, moving a higher proportion of scientists closer to the rural environments to which their research should relate, and in which much of it should be conducted.

Second, cost-effective rural appraisal might be developed much more systematically as a subject. Rapid appraisal of rural situations is widely practiced but not much written about.² Authors are coy about describing the way they find out about rural situations when time is short. Yet rapid rural appraisal is very widely undertaken and its methods are continuously being improved by practitioners; but they lack the respectability of elephantine surveys or profound participant observation. They are described apologetically as "quick and dirty" when in practice much conventional rural research is inefficient — "long and dirty" — and much rapid work is "quick and clean." Ladejinsky, for example, identified the adverse distributional effects of the "green revolution" on brief field visits in India (Ladejinsky 1969a, 1969b, cited in Clay 1978), years before expensive, extensive surveys came up with the same findings to two (spurious) decimal points. There is much potential here for new methods of learning from rural people, for example through repertory grid techniques (Richards 1979) and appropriate methods of quantification (Barket 1979). Armed with cost-effective "quick and clean" methods of learning from rural people

2. See, however, the papers of the Workshop on Rapid Rural Appraisal, Institute of Development Studies, University of Sussex, November 1978. See also the work of Belshaw (1976), Biggs (1978), Collinson (CIMMYT 1977, 1978) and Hildebrand (1978), and forthcoming from CIMMYT, "Planning Technologies Appropriate to Farmers' Circumstances: A Manual of Procedures."

and about rural situations, technical and social scientists engaged in R & D should be able to short-circuit long channels of noncommunication and should be able to experience and learn for themselves much more directly.

Third, changes might be made in professional reward systems for researchers, relating these to desired behavior. Some of the most serious socioeconomic constraints to development are in ourselves, the elite professionals who write papers and conduct research. What are the things we do not see, understand or do because of our conditioning, motives, and lifestyles? It is easier to ask this question than to answer it; and the writer makes no pretense to any virtue on this score. But perhaps more could be done through rewards to those scientists who pioneer new methods that truly serve the poorer people, who work on subjects of low prestige, and who work in creative partnership with rural people.

Finally, there is the question of who does what. If war is too important to be left to the generals, as Clemenceau believed, social scientists have also been right in arguing that agricultural and mechanical R & D is too important to be left to technical scientists. The most common, and desirable, response has been to add social scientists to the staffs of research institutes and stations, and sometimes they are involved in research decisions. But the social and economic implications of prospective technologies seem too important to be left just to the social scientists. Multidisciplinary collaboration has its uses and its place. It is especially vital in determining research priorities and the allocation of research resources. But it also has its well-known difficulties and costs. The Duchess in Alice in Wonderland might have been speaking for many who feel that the involvement of many disciplines slows up decisions and action. At the same time, the social and economic implications of new technology are so great that technical scientists cannot wash their hands of them: it is the irresponsibility, in part, to see "where the rockets come down." Perhaps solutions can be sought in all professionals becoming more truly multidisciplinary, in social scientists learning to think more like technical scientists, in technical scientists learning to think more like social scientists, and in all alike working with and learning from those true multidisciplinary, the rural people themselves.

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